Claims

What is claimed is:

1. A MEMS-based accelerometer, comprising:

a generally planar semiconductor substrate having a top surface;

a generally hollow shell having an open end and a closed end, therein defining a cavity within the shell, wherein the open end of the shell is generally bonded to the top surface of the substrate, wherein the closed end of the shell is generally parallel to the top surface of the substrate and comprises a plurality of capacitor plates electrically connected to a respective plurality of capacitor electrodes associated with the shell, wherein the shell further comprises a common electrode, and wherein the plurality of capacitor electrodes and the common electrode are electrically connected to the substrate *via* the bonding of the open end of the shell to the substrate;

an elongate electrically conductive torsion bar, wherein ends of the torsion bar are coupled to the shell within the cavity, wherein the torsion bar is electrically connected to the common electrode of the shell, and wherein the torsion bar generally defines an axis of rotation;

an elongate proof mass coupled to the torsion bar;

a plurality of electrically conductive paddles coupled to the torsion bar and the proof mass, therein electrically connecting the paddles to the torsion bar, wherein the plurality of paddles extend generally parallel to the top surface of the substrate and outwardly from the axis of rotation and are generally symmetric to one another about the axis of rotation, and wherein each of the plurality of paddles is suspended by the torsion bar from a respective one or the plurality of capacitor plates by a predetermined first distance, therein defining a respective plurality of capacitors, wherein a movement of the proof mass is operable to cause a rotation of the paddles about the axis of rotation, therein changing a capacitance between the plurality of paddles and the respective plurality of capacitor plates.

2. The accelerometer of claim 1, wherein the shell is bonded to the substrate by a plurality of solder balls, wherein the plurality of solder balls electrically connect the shell to the substrate.

3. The accelerometer of claim 2, wherein the plurality of solder balls further generally seal the cavity from an external environment.

4. The accelerometer of claim 2, wherein the plurality of solder balls electrically connect the common electrode and the plurality of capacitor electrodes to a plurality of electrodes associated with the substrate.

5. The accelerometer of claim 3, wherein the common electrode is electrically connected to a common voltage potential associated with the substrate.

6. The accelerometer of claim 2, further comprising a sealing layer of frit glass, wherein the frit glass provides a hermetic seal between the shell and the substrate.

7. A MEMS based accelerometer system, comprising:

a MEMS shell having a cavity therein, the MEMS shell further comprising a capacitive accelerometer arrangement integrated therein; and

a semiconductor substrate having a top surface, wherein the MEMS shell is configured with respect to the substrate such that the cavity faces down toward the top surface of the substrate, and wherein the MEMS shell is bonded to the substrate and electrically coupled thereto through the bonding arrangement, thereby sealing the cavity.

8. The MEMS based accelerometer system of claim 7, wherein the capacitive accelerometer arrangement comprises:

a pair of individually isolated capacitor plates overlying a bottom portion of the cavity;

a torsion bar coupled to the shell and spanning a portion of the cavity, wherein the torsion bar defines an axis of rotation;

a proof mass coupled to the torsion bar; and

a pair of electrically conductive paddles coupled to the torsion bar and extending generally parallel to the pair of capacitor plates, respectively, and defining a spacing therebetween, wherein the capacitor plates and conductive paddles define a pair of accelerometer capacitors.

9. The MEMS based accelerometer system of claim 8, wherein the spacing between the capacitor plates and the conductive paddles, respectively, is substantially equal when an acceleration on the system is substantially zero.

10. The MEMS based accelerometer system of claim 7, wherein the MEMS shell further comprises conductive regions at an interface portion thereof and electrical connections between the elements of the capacitive accelerometer arrangement and the conductive regions.

11. The MEMS based accelerometer system of claim 10, wherein the conductive regions are electrically isolated from one another and make selective electrical contact to circuitry associated with the semiconductor substrate.

12. The MEMS based accelerometer system of claim 11, wherein the selective electrical contact comprises solder balls that are flowed under heating conditions to establish an electrical connection.

13. The MEMS based accelerometer system of claim 11, wherein regions between the MEMS shell and the semiconductor substrate not associated with the conductive regions have insulative material thereon to

facilitate the sealing of the cavity and electrical isolation of the electrical connections.

14. The MEMS based accelerometer system of claim 13, wherein the insulative material comprises frit glass.

15. The MEMS based accelerometer system of claim 14, wherein the frit glass comprises flowed frit glass formed under heating conditions, wherein the flowed frit glass generally hermetically seals the cavity.